

Amendments to the claims:

1. (Currently amended) A method for asynchronously transmitting one or more incremental database updates from a ~~primary volume~~ at a primary site to a ~~remote volume~~ at a remote site, the primary site and the remote site interconnected by at least one communication link, the method comprising the steps of:

(a) destaging modified data to the ~~primary~~ a first volume at the primary site for a current database update and updating one or more bits in a first bitmap at the primary site that indicate one or more tracks on the ~~primary~~ first volume that are to be overwritten with the modified data;

(b) performing a first point in time virtual copy of the modified data of the first volume to a second volume at the primary site by transferring the first bitmap to a second bitmap at the primary site for indicating the modified data that is to be transmitted to a third the remote volume, which is at the remote site, for the current database update; and

(c) synchronizing the primary second volume at the primary site with the third remote volume at the remote site for the current database update by transmitting the modified data of the second volume to the third remote volume as indicated by the one or more bits in the second bitmap; and

~~, wherein the one or more incremental database updates at the primary volume of the primary site are decoupled from transmission of the one or more incremental database updates to the remote volume at the remote site~~

(d) performing a second point in time virtual copy of the modified data of the third volume to a fourth volume, which is at the remote site.

2. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, wherein the first bitmap represents a FlashCopy bitmap and the second bitmap represents a peer-to-peer remote copy (PPRC) bitmap.

3. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, the method further comprising a step of wherein the first point in time virtual copy is achieved by flashcopying the modified data of the first primary volume at the primary site to the second a target volume at the primary site for the current database update.

4. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 3, wherein the step of flashcopying initializes the one or more bits in the first FlashCopy bitmap.

5. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, the method further comprising a step of wherein the second point in time virtual copy is achieved by flashcopying the modified data of the third remote volume at the remote site to the fourth a target volume at the remote site for the current database update.

6. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, the method further comprising a step of providing an application host that is coupled to associated with the first primary volume for performing the one or more incremental database updates at the primary volume.

7. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, the method further comprising a step of staggering the one or more incremental database updates during the current database update.

8. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 7+, wherein the step of staggering comprises the steps of:

determining whether a synchronization for a previous database update is complete after performing the destaging is performed step of destaging for the current database update; and

waiting for the synchronization of the previous database update to complete before the step of performing the first point in time virtual copy transferring the first bitmap to the second bitmap for the current database update.

9. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of claim 8, wherein the step of staggering further comprises comprising a step of:

flashto-copying the primary volume at the primary site to a secondary volume at the primary site and initializing the first bitmap for a next database update after the performing the first point in time virtual copy transferring step for the current database update; and

waiting for the next database update after the synchronizing step for the current database update.

10. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 15, wherein the synchronizing is achieved by the method further comprising a step of establishing a peer to peer remote copy session between the second target volume at the primary site and the third remote volume at the remote site for physically transmitting the modified data of the second volume over the at least one communication link to the third remote volume for the current database update.

11. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 13, the method further comprising a step of providing a controller at the primary site for managing access to both the first primary volume and the second target volume at the primary site; and

providing a controller at the remote site for managing access to the third volume and the fourth volume.

12. (Cancelled)

13. (Currently amended) The method for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 1, ~~the method further comprising the steps of:~~

initializing the first bitmap to indicate that all data on the first primary volume at the primary site is to be copied to the second remote volume, and all data that is copied to the second volume is to be copied to the third volume at the remote site;

— synchronizing the data from the primary volume at the primary site to the remote volume at the remote site; and

— flashcopying the remote volume at the remote site to a target volume at the remote site.

14. (Currently amended) The method for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 1-3, ~~the method further comprising a step of providing a recovery host that is coupled to~~ associated with the fourth target volume at the remote site for recovering from a failure of the primary site by providing access to the fourth volume transmitted incremental database updates from the primary site.

15. (Currently amended) The method for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 1, ~~the method further comprising a step of automatically initiating the incremental database updates data update~~.

16. (Currently amended) The method for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 1, wherein the step of ~~destaging further comprises comprising the steps of:~~

inspecting the one or more bits of the first bitmap at the primary site to determine whether the second target volume at the primary site includes data of the one or more tracks on the first volume that are to be overwritten with the modified data; and

performing a point in time virtual copy eopying, from the first volume to the second volume, of the data of the one or more tracks on the first volume that are that is to be overwritten with the modified data to the target volume at the primary site if the first bitmap

indicates that the second target volume does not include the data of the one or more tracks on the first volume that are to be overwritten with the modified data.

17. (Currently amended) The method for asynchronously transmitting one or more incremental database updates according to of Claim 1, wherein the at least one communication link comprises at least one is selected from the group consisting of: of a channel link; a T1/T3 link; a Fibre channel; and an ESCON link.

18. (Currently amended) A system for asynchronously transmitting one or more incremental database updates from a primary volume at a primary site to a remote volume at a remote site, the primary site and the remote site interconnected by at least one communication link, the system comprising:

a local controller associated with the primary site comprising:

a means for destaging modified data to a first the primary volume at the primary site for a current database update and updating one or more bits in a first bitmap at the primary site that indicate one or more tracks on the first primary volume that are to be overwritten with the modified data;

a first means for performing a point in time virtual copy of the modified data of the first volume to a second volume at the primary site by transferring the first bitmap to a second bitmap at the primary site for indicating the modified data that is to be transmitted to a third the remote volume, which is at the remote site, for the current database update; and

a means for synchronizing the second primary volume at the primary site with the third remote volume at the remote site for the current database update by transmitting the modified data of the second volume to the third remote volume as indicated by the one or more bits in the second bitmap; and

, wherein the one or more incremental database updates at the primary volume of the primary site are decoupled from transmission of the one or more incremental database updates to the remote volume at the remote site

second means for performing a point in time virtual copy of the modified data of the third volume to a fourth volume, which is at the remote site.

19. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, wherein the first bitmap represents a FlashCopy bitmap and the second bitmap represents a peer-to-peer remote copy (PPRC) bitmap.

20. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, ~~the system further comprising a~~ wherein the first means performs a means of flashcopying of the modified data of the first the primary volume at the primary site to the second a target volume at the primary site for the current database update.

21. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 20, wherein the means for flashcopying initializes the one or more bits in the first bitmap.

22. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, ~~the system further comprising a~~ remote controller associated with the remote site comprising a means for wherein the second means performs a flashcopying of the modified data of the third remote volume at the remote site to the fourth a target volume at the remote site for the current database update.

23. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, ~~the system further comprising an~~ application host that is coupled to associated with the first primary volume for performing the one or more incremental database updates at the primary volume.

24. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, ~~the system further comprising a~~ means for staggering the one or more incremental database updates during the current database update.

25. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ ~~of~~ Claim 24 ~~18~~, wherein the means for staggering comprises: ~~means for determining~~ determines whether a synchronization for a previous database update is complete, after performing the step of ~~destaging is performed~~ for the current database update; and ~~waits~~ means for waiting for the synchronization of the previous database update to complete before the step of transferring ~~of~~ the first bitmap to the second bitmap for the current database update.

26. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ ~~of~~ claim 25, wherein the means for staggering further comprising: ~~means for flashecopying the primary volume at the primary site to a secondary volume at the primary site and initializing~~ initializes the first bitmap for a next database update after the ~~first~~ means performs the point in time virtual copy transferring step for the current database update; and ~~waits~~ means for waiting for the next database update after the means for synchronizing synchronizes the second volume with the third volume step for the current database update.

27. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ ~~of~~ Claim 18 ~~22~~, the controller further comprising a wherein the means for synchronizing establishes a peer to peer remote copy adapter for establishing a peer to peer remote copy session between the second target volume at the primary site and the third remote volume at the remote site to for physically transmitting transmit the modified data of the second volume over the at least one communication link to the third remote volume for the current database update.

28. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ ~~of~~ Claim 18, wherein the controller at the primary site comprises a device adapter further comprising means for managing access to both the first primary volume and the second target volume at the primary site; and means for managing access to the third volume and the fourth volume.

29. (Cancelled).

30. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, wherein the local controller associated with the primary site further comprising comprises:

means for initializing the first bitmap to indicate that all data ~~on~~ of the first primary volume at the primary site is to be copied to the second remote volume, and all data that is copied to the second volume is to be copied to the third volume at the remote site;

~~means for synchronizing the data from the primary volume at the primary site to the remote volume at the remote site; and~~

~~means for flashcopying the remote volume at the remote site to a target volume at the remote site.~~

31. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18 ~~30~~, the system further comprising a recovery host that is coupled to associated with the fourth target volume at the remote site for recovering from a failure of the primary site by providing access to the fourth volume transmitted incremental database updates from the primary site.

32. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, the system further comprising a means for automatically initiating the incremental database updates data update.

33. (Currently amended) The system for ~~asynchronously transmitting one or more incremental database updates according to~~ of Claim 18, wherein the means for destaging further compromises:

means for inspecting the one or more bits of the first bitmap at the primary site to determine whether the second a target volume at the primary site includes data of the one or more tracks on the first volume that are to be overwritten with the modified data; and

means for performing a point in time virtual copy copying, from the first volume to the second volume, of the data of the one or more tracks on the first volume that are that is to

be overwritten with the modified data to the target volume at the primary site if the first bitmap indicates that the second target volume does not include the data of the one or more tracks on the first volume that are to be overwritten with the modified data.

34. (Currently amended) ~~The system for asynchronously transmitting one or more incremental database updates according to of~~ Claim 18, wherein the at least one communication link comprises at least one of is selected from the group consisting of: a channel link; a T1/T3 link; a Fibre channel; and an ESCON link.

35. (Cancelled)

36. (Currently amended) A program storage device, tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates from ~~a primary volume at a primary site to a remote volume at a remote site, the primary site and the remote site interconnected by at least one communication link, the method comprising the steps of:~~

(a) destaging modified data to a first the primary volume at the primary site for a current database update and updating one or more bits in a first bitmap at the primary site that indicate one or more tracks on the first primary volume that are to be overwritten with the modified data;

(b) performing a first point in time virtual copy of the modified data of the first volume to a second volume at the primary site by transferring the first bitmap to a second bitmap at the primary site for indicating the modified data that is to be transmitted to a third the remote volume, which is at the remote site, for the current database update; and

(c) synchronizing the second primary volume at the primary site with the third remote volume at the remote site for the current database update by transmitting the modified data of the second volume to the third remote volume as indicated by the one or more bits in the second bitmap; and

~~, wherein the one or more incremental database updates at the primary volume of the primary site are decoupled from transmission of the one or more incremental database updates to the remote volume at the remote site~~

(d) performing a second point in time virtual copy of the modified data of the third volume to a fourth volume, which is at the remote site.

37. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, wherein the first bitmap represents a FlashCopy bitmap and the second bitmap represents a peer-to-peer remote copy (PPRC) bitmap.

38. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, the method further comprising a step of wherein the first point in time virtual copy is achieved by flashcopying the modified data of the first primary volume at the primary site to the second a target volume at the primary site for the current database update.

39. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 38, wherein the step of flashcopying initializes the one or more bits in the first bitmap.

40. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, the method further comprising a step of wherein the second point in time virtual copy is achieved by flashcopying the modified data of the third remote volume at the remote site to the fourth a target volume at the remote site for the current database update.

41. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, wherein the

method further comprises ~~comprising~~ a step of providing an application host that is ~~coupled to~~ associated with the first primary volume for performing the one or more incremental database updates ~~at the primary volume~~.

42. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, ~~the method further comprising a step of staggering the one or more incremental database updates during the current database update.~~

43. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 42, ~~36, wherein the step of staggering comprises the steps of:~~

~~determining whether a synchronization for a previous database update is complete after the step of destaging is performed performing the step of destaging for the current database update; and~~

~~waiting for the synchronization of the previous database update to complete before the step of performing the first point in time virtual copy transferring the first bitmap to the second bitmap for the current database update.~~

44. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 43, ~~wherein the step of staggering further comprises~~ ~~comprising~~ a step of:

~~flashecopying the primary volume at the primary site to a secondary volume at the primary site and initializing the first bitmap for a next database update after the step of performing the first point in time virtual copy transferring step for the current database update; and~~

~~waiting for the next database update after the synchronizing step for the current database update.~~

45. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of Claim 36~~ 40, the method further comprising a step of wherein the synchronizing is achieved by establishing a peer to peer remote copy session between the second target volume at the primary site and the third remote volume at the remote site for physically transmitting the modified data of the second volume over the at least one communication link to the third remote volume for the current database update.

46. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of Claim 36~~ 38, wherein the method further comprising a step of comprises providing a controller at the primary site for managing access to both the first primary volume and the second target volume at the primary site; and

providing a controller at the remote site for managing access to the third volume and the fourth volume.

47. (Cancelled)

48. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of Claim 36~~, wherein the method further comprises comprising the steps of:

initializing the first bitmap to indicate that all data on of the first primary volume at the primary site is to be copied to the second remote volume, and all data that is copied to the second volume is to be copied to the third volume at the remote site;

synchronizing the data from the primary volume at the primary site to the remote volume at the remote site; and

flasheopying the remote volume at the remote site to a target volume at the remote site.

49. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36 48, wherein the method further comprises comprising a step of providing a recovery host that is coupled to associated with the fourth target volume at the remote site for recovering from a failure of the primary site by providing access to the fourth volume transmitted incremental database updates from the primary site.

50. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, wherein the method further comprises comprising a step of automatically initiating the incremental database updates data update.

51. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, wherein the step of destaging further comprises comprising the steps of:

inspecting the one or more bits of the first bitmap at the primary site to determine whether the second a target volume at the primary site includes data of the one or more tracks on the first volume that are to be overwritten with the modified data; and

performing a point in time virtual copy eopying from the first volume to the second volume, of the data of the one or more tracks on the first volume that are is to be overwritten with the modified data to the target volume at the primary site if the first bitmap indicates that the second target volume does not include the data of the one or more tracks on the first volume that are to be overwritten with the modified data.

52. (Currently amended) The program storage device, ~~tangibly embodying a program of instructions executable by a machine to perform a method for asynchronously transmitting one or more incremental database updates according to of~~ Claim 36, wherein the at

least one communication link comprises at least one of is selected from the group consisting of: a channel link; a T1/T3 link; a Fibre channel; and an ESCON link

53. (New) The method of claim 1, wherein during the synchronizing, the first volume is accessible to a host at the primary site, and the fourth volume is accessible to a host at the remote site.

54. (New) The system of claim 18, wherein during the synchronizing, the first volume is accessible to a host at the primary site, and the fourth volume is accessible to a host at the remote site.

55. (New) The program storage device of claim 36, wherein during the synchronizing, the first volume is accessible to a host at the primary site, and the fourth volume is accessible to a host at the remote site.

56. (New) A method for backing up data from a primary site to a remote site, comprising:

(a) destaging modified data to a first volume at the primary site for a current database update;

(b) performing a first point in time virtual copy of the modified data of the first volume to a second volume at the primary site;

(c) synchronizing the second volume with a third volume at the remote site by transmitting the modified data of the second volume to the third volume; and

(d) after completion of the synchronizing, performing a second point in time virtual copy of the modified data of the third volume to a fourth volume at the remote site;

wherein, during the synchronizing, the first volume is accessible to a host at the primary site, and the fourth volume is accessible to a host at the remote site.